



PATENT
Attorney Docket No.: COOL-01901

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Daniel J. Lenehan et al.

Serial No.: 10/731,674

Filed: December 8, 2003

For: **PUMP AND FAN CONTROL
CONCEPTS IN A COOLING
SYSTEM**

) Group Art Unit: 3753

) Examiner:

) **TRANSMITTAL LETTER**

) 162 N. Wolfe Road
) Sunnyvale, CA 94086
) (408) 530-9700

) Customer No.: 28960

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Sir:

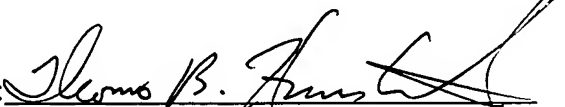
Enclosed please find an Information Disclosure Statement and Form PTO-1449, including copies of the references contained thereon, for filing in the U.S. Patent and Trademark Office.

You will also find enclosed the associated Transmittals, Electronic Information Disclosure Statements, and United States Patent and Trademark Office Acknowledgment Receipts for the electronically filed Information Disclosure Statement (EFS ID #58124); (EFS ID #58126); and (EFS ID #58127) filed on March 30, 2004.

The Commissioner is hereby authorized to charge any additional fee or credit overpayment to our Deposit Account No. 08-1275. **An originally executed duplicate of this transmittal is enclosed for this purpose.**

Respectfully submitted,
HAVERSTOCK & OWENS LLP

Dated: 3-30-04

By: 
Thomas B. Haverstock
Reg. No.: 32,571

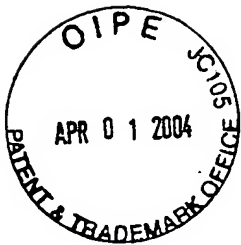
Attorneys for Applicants

CERTIFICATE OF MAILING (37 CFR § 1.8(a))

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited with the U.S. Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the: Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450

HAVERSTOCK & OWENS LLP

Date: 3-30-04 By: 



PATENT
Attorney Docket No.: COOL-01901

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Daniel J. Lenehan et al.

Serial No.: 10/731,674

Filed: December 8, 2003

For: **PUMP AND FAN CONTROL
CONCEPTS IN A COOLING
SYSTEM**

) Group Art Unit: 3753

) Examiner:

) **INFORMATION DISCLOSURE**
) **STATEMENT**

) 162 N. Wolfe Road
) Sunnyvale, CA 94086
) (408) 530-9700

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Sir:

The citations listed below, copies attached, may be material to the examination of the above-identified application, and are therefore submitted in compliance with the duty of disclosure defined in 37 C.F.R. §§ 1.56 and 1.97. The Examiner is requested to make these citations of official record in this application.

United States Patents or Published Patent Applications have been filed electronically (EFS ID #58124); (EFS ID #58126); and (EFS ID #58127). Applicants have become aware of the following printed publication which may be material to the examination of this application:

- Chinese Publication No. CN 97212126.9;
- Japanese Patent Abstract JP 2000-277540;
- Stephen C. Jacobson et al., "Fused Quartz Substrates for Microchip Electrophoresis", Analytical Chemistry, Vo. 67, No. 13, July 1, 1995, pages 2059-2063;
- Kendra V. Sharp et al., "Liquid Flows in Microchannels", 2002, Vol. 6, pages 6-1 to 6-38;
- Shuchi Shoji et al., "Microflow devices and systems", J. Microcech. Microeng. 4 (1994), pages 157-171, printed in the U.K;

- Angela Rasmussen et al., "Fabrication Techniques to Realize CMOS-Compatible Microfluidic Microchannels", Journal of Microelectromechanical, Vo. 10, No. 2, June 2001, pages 286-297;
- J. H. Wang et al., "Thermal-Hydraulic Characteristic of Micro Heat Exchangers", 1991, DSC-Vol. 32, Micromechanical Sensors, Actuators, and Systems, pages 331-339;
- Gad Hetsroni et al., "Nonuniform Temperature Distribution in Electronic Devices Cooled by Flow in Parallel Microchannels", IEEE Transactions on Components and Packaging Technologies, March 2001, Vol. 24, No. 1, pages 16-23;
- X. F. Peng et al., "Heat Transfer Characteristics of Water Flowing through Microchannels", Experimental Heat Transfer An International Journal, Vol. 7, No. 4, October-December 1994, pages 265-283;
- Linan Jiang et al., "Forced Convection Boiling in a Microchannel Heat Sink", Journal of Microelectromechanical Systems, Vol. 10, No. 1, March 2001, pages 80-87;
- Muhammad M. Rahman et al., "Experimental Measurements of Fluid Flow and Heat Transfer in Microchannel Cooling Passages in a Chip Substrate", 1993, EEP-Vol. 4-2, Advances in Electronic Packages, pages 685-692;
- X. F. Peng et al., "Forced convection and flow boiling heat transfer for liquid flowing through Microchannels", 1993, Int. J. Heat Mass Transfer, Vol. 36, NO. 14, pages 3421-3427;
- Lung-Jieh Yang et al., "A Micro Fluidic System of Micro Channels with On-Site Sensors by Silicon Bulk Micromaching", September 1999, Microfluidic Devices and Systems II, Vol. 3877, pages 267-272;
- G. Mohiuddin Mala et al., "Heat transfer and fluid flow in microchannels", 1997, Int. J. Mass transfer, Vol. 40, No. 13, pages 3079-3088, printed in Great Britain;
- J. M. Cuta et al., "Fabrication and Testing of Micro-Channel Heat Exchangers", SPIE Microlithography and Metrology in Micromaching, Vol. 2640, 1995, pages 152-160;

- Linan Jiang et al., "A Micro-Channel Heat Sink with Integrated Temperature Sensors for Phase Transition Study", 1999, 12th IEEE International Conference on Micro Electro Mechanical Systems, pages 159-164;
- Linan Jiang et al., "Fabrication and characterization of a microsystem for a micro-scale heat transfer study", J. Micromech. Microeng. 9 (1999) pages 422-428, printed in the U.K;
- M. B. Bowers et al., "High flux boiling in low flow rate, low pressure drop mini-channel and micro-channel heat sinks", 1994, Int. J. Heat Mass Transfer, Vol. 37, No. 2, pages 321-332;
- Yongendra Joshi, "Heat out of small packages", December 2001, Mechanical Engineer, pages 56-58;
- A. Rostami et al., "Liquid Flow and Heat Transfer in Microchannels: a Review", 2000, Heat and Technology, Vol. 18, No. 2, pages 59-68;
- Lian Zhang et al., "Measurements and Modeling of Two-Phase Flow in Microchannels with Nearly Constant Heat Flux Boundary Conditions", Journal of Microelectromechanical Systems, Vol.11, No. 1, February 2002, pages 12-19;
- Muhammad Mustafizur Rahman, "Measurements of Heat Transfer in Microchannel Heat Sinks", Int. Comm. Heat Mass Transfer, Vol. 27, No. 4, May 2000, pages 495-506;
- Issam Mudawar et al., "Enhancement of Critical Heat Flux from High Power Microelectronic Heat Sources in a Flow Channel", Journal of Electronic Packaging, September 1990, Vol. 112, pages 241-248;
- Nelson Kuan, "Experimental Evaluation of Micro Heat Exchangers Fabricated in Silicon", 1996, HTD-Vol. 331, National Heat Transfer Conference, Vol. 9, pages 131-136;
- E. W. Kreutz et al., "Simulation of micro-channel heat sinks for optoelectronic microsystems", Microelectronics Journal 31(2000) pages 787-790;
- J. C. Y. Koh et al., "Heat Transfer of Microstructure for Integrated Circuits", 1986, Int. Comm. Heat Mass Transfer, Vol. 13, pages 89-98;
- Snezana Konecni et al., "Convection Cooling of Microelectronic Chips", 1992, InterSociety Conference on Thermal Phenomena, pages 138-144;

- Michael B. Kleiner et al., "High Performance Forced Air Cooling Scheme Employing Microchannel Heat Exchangers", 1995, IEEE Transactions on Components, Packaging, and Manufacturing Technology-Part A, Vol. 18, No. 4, pages 795-804;
- Jerry K. Keska Ph. D. et al., "An Experimental Study on an Enhanced Microchannel Heat Sink for Microelectronics Applications", EEP-Vol. 26-2, Advances in Electronic Packaging, 1999, Vol. 2, pages 1235-1259;
- Shung-Wen Kang et al., "The Performance Test and Analysis of Silicon-Based Microchannel Heat Sink", July 1999, Terahertz and Gigahertz Photonics, Vol. 3795, pages 259-270;
- Joseph C. Tramontana, "Semiconductor Laser Body Heat Sink", Xerox Disclosure Journal, Vol. 10, No. 6, November/December 1985, pages 379-381;
- Sarah Arulanandam et al., "Liquid transport in rectangular microchannels by electroosmotic pumping", Colloid and Surfaces A: Physicochemical and Engineering Aspects 161 (2000) , pages 89-102;
- Jeffery D. Barner et al., "Thermal Ink Jet Print Head Carriage with Integral Liquid Cooling Capabilities", Xerox Disclosure Journal-Vol. 21, No. 1, January/February 1996, pages 33-34;
- "Autonomous displacement of a solution in a microchannel by another solution", Research Disclosure, June 2001, pages 1046-1047;
- John M. Waldvogel, "Aluminum Silicon Carbide Phase Change Heat Spreader", Motorola, June 1999, Technical Developments, pages 226-230;
- James P. Slupe et al., "An idea for maintaining a stable thermal environment for electronic devices", Research Disclosure, August 2001, page 1312;
- John M. Waldvogel, "A Heat Transfer Enhancement Method for Forced Convection Bonded-Fin Heatsinks", Motorola, December 1997, Technical Developments, pages 158-159;
- "Thin Heat Pipe for Cooling Components on Printed Circuit Boards", IBM Technical Disclosure Bulletin, Vol. 34, No. 7B, December 1991, pages 321-322;
- R. C. Chu et al., "Process for Nucleate Boiling Enhancement", IBM Technical Disclosure Bulletin, Vol. 18, No. 7, December 1975, page 2227;

- J. Riseman, "Structure for Cooling by Nucleate Boiling", IBM Technical Disclosure Bulletin, Vol. 18, No. 11, April 1976, page 3700;
- "Integrally Grooved Semiconductor Chip and Heat Sink", October 1971, IBM Technical Disclosure Bulletin, Vol. 14, No. 5, page 1425;
- "Enhanced Cooling of Thermal Conduction Module", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 426;
- "Heat Exchanger Modules for Data Process with Valves Operated by Pressure form Cooling Water Pump", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 419;
- "Cold Plate for Thermal Conduction Module with Inlet for Cooling Water Near Highest Power Chips", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 413;
- "Circuit Module Cooling with Coaxial Bellow Providing Inlet, Outlet and Redundant Connections to Water-Cooled Element", IBM Technical Bulletin, Vol. 30, No. 5, October 1987, pages 345-347;
- "Piping System with Valves Controlled by Processor for Heating Circuit Modules in a Selected Temperature Profile for Sealing Integrity Test Under Temperature Stress", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 336;
- "Cooling System for Chip Carrier on Card", IBM Technical Disclosure Bulletin, Vol. 31, No. 4, September 1988, pages 39-40;
- "Chip Cooling Device", IBM Technical Disclosure Bulletin, Vol. 30, No. 9, February 1988, pages 435-436;
- W. E. Ahearn et al., "Silicon Heat Sink Method to Control Integrated Circuit Chip Operating Temperatures", IBM Technical Disclosure Bulletin, Vol. 21, No. 8, January 1979, pages 3378-3380;
- N. P. Bailey et al., "Cooling Device for Controlled Rectifier", IBM Technical Disclosure Bulletin, Vol. 21, No. 11, April 1979, pages 4609-4610;
- W. J. Kleinfelder et al., "Liquid-Filled Bellows Heat Sink", IBM Technical Disclosure Bulletin, Vol. 21, No. 10, March 1979, pages 4125-4126;
- R. P. Chrisfield et al., "Distributed Power/Thermal Control", IBM Technical Disclosure Bulletin, Vol. 22, No. 3, August 1979, pages 1131-1132;

- A. J. Arnold et al., "Heat Sink Design for Cooling Modules in a Forced Air Environment", IBM Technical Disclosure Bulletin, Vol. 22, No. 6, November 1979, pages 2297-2298;
- A. J. Arnold, "Structure for the Removal of Heat from an Integrated Circuit Module", IBM Technical Disclosure Bulletin, Vol. 22, No. 6, November 1979, pages 2294-2296;
- U. P. Hwang et al., "Cold Plate for Thermal Conduction Module with Improved Flow Pattern and Flexible Base", IBM Technical Disclosure Bulletin, Vol. 25, No. 9, February 1983, page 4517;
- K. C. Gallagher et al., "Cooling System for Data Processor with Flow Restrictor in Secondary Loop to Limit Bypass-Cooling Water Flow", IBM Technical Disclosure Bulletin, Vol. 26, No. 5, October 1983, page 2658;
- R. C. Chu et al., "Silicon Heat Sink for Semiconductor Chip", IBM Technical Disclosure Bulletin, Vol. 24, No. 11A, April 1982, page 5743;
- J. M. Eldridge et al., "Heat-Pipe Vapor Cooling Etched Silicon Structure", IBM Technical Disclosure Bulletin, Vol. 25, No. 8, January 1983, pages 4118-4119;
- J. R. Skobern, "Thermoelectrically Cooled Module", IBM Technical Disclosure Bulletin, Vol. 27, No. 1A, June 1984, page 30;
- M. J. Brady et al., "Etched Silicon Integrated Circuit Heat Sink", IBM Technical Disclosure Bulletin, Vol. 27, No. 1B, June 1984, page 627;
- H. D. Edmonds et al., "Heat Exchange Element for Semiconductor Device Cooling", IBM Technical Disclosure Bulletin, Vol. 23, No. 3, August 1980, page 1057;
- R. W. Noth, "Heat Transfer from Silicon Chips and Wafers", IBM Technical Disclosure Bulletin, Vol. 17, No. 12, May 1975, page 3544;
- "Forced Boiling Cooling System with Jet Enhancement for Critical Heat Flux Extension", IBM Technical Disclosure Bulletin, Vol. 39, No. 10, October 1996, page 143;
- "Miniature Heat Exchanger for Corrosive Media", IBM Technical Disclosure Bulletin, Vol. 38, No. 01, January 1995, pages 55-56;

- “Self-Contained Active Heat Dissipation Device”, IBM Technical Disclosure Bulletin Vol. 39, No. 04, April 1996, pages 115-116;
- C. J. Keller et al., “Jet Cooling Cup for Cooling Semiconductor Devices”, IBM Technical Disclosure Bulletin, Vol. 20, No. 9, February 1978, pages 3575-3576;
- B. J. Ronkese, “Centerless Ceramic Package with Directly Connected Heat Sink”, IBM Technical Disclosure Bulletin, Vol. 20, No. 9, February 1978, page 3577-3578;
- K. S. Sachar, “Liquid Jet Cooling of Integrated Circuit Chips”, Vol. 20, No. 9, February 1978, pages 3727-3728;
- A. H. Johnson, “Device Cooling”, IBM Technical Disclosure Bulletin, Vol. 20, No. 10, March 1978, pages 3919-3920;
- A. L. Pacuzzo et al., “Integrated Circuit Module Package Cooling Structure”, IBM Technical Disclosure Bulletin, Vol. 20, No. 10, March 1978, pages 3898-3899;
- R. D. Durand et al., “Flexible Thermal Conductor for Electronic Module”, IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, page 4343;
- D. Balderes et al., “Liquid Cooling of a Multichip Module Package”, IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, pages 4336-4337;
- J. A. Dorler et al., “Temperature Triggerable Fluid Coupling System for cooling Semiconductor Dies”, IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, pages 4386-4388;
- V. W. Antonetti et al., “Integrated Module Heat Exchanger”, IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, page 4498;
- P. Hwang et al., “Conduction Cooling Module”, IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, pages 4334-4335;
- A. J. Arnold, “Electronic Packaging Structure”, IBM Technical Disclosure Bulletin, Vol. 20, No. 11B, April 1978, pages 4820-4822;
- V. Y. Doo et al., “High Performance Package for Memory”, IBM Technical Disclosure Bulletin, Vol. 21, No. 2, July 1978, pages 585-586;
- “Multi-Chip Package with Cooling by a Spreader Plate in Contact with a Chip having Cylindrical Holes Mating with an Inverse Frame Providing Water

Flow Within its Pins”, IBM Technical Disclosure Bulletin, Vol. 31, No. 5, October 1988, pages 141-142;

- J. Landrock et al., “Cooling System for Semiconductor Chips”, IBM Technical Disclosure Bulletin, Vol. 23, No. 4, September 1980, page 1483;
- E. P. Damm, Jr., “Convection Cooling Apparatus”, IBM Technical Disclosure Bulletin, Vol. 20, No. 7, December 1977, pages 2755-2756;
- “Circuit Package with Circulating Boiling Liquid and Local Heat Exchanger to Limit Vapor in Coolant Outlet”, IBM Technical Disclosure Bulletin, Vol. 31, No. 12 May 1989, page 34;
- “Circuit Module Cooling with Multiple Pistons Contacting a Heat Spreader/Electrical Buffer Plate in Contact with Chip”, IBM Technical Disclosure Bulletin, Vol. 31, No. 12, May 1989, page 5-7;
- “TCM-LIKE Circuit Module with Local Heat Sink Resting on Chip and Chip Separated From Coolant by Bellows with Pins and Deflector Plate Attached to Local Heat Sink and Extending Above Bellows into Region of Coolant Flow”, IBM Technical Disclosure Bulletin, Vol. 31, No. 11, pages 305-306;
- “Water-Cooled Circuit Module with Grooves Forming Water Passages Near Heat-Producing Devices”, IBM Technical Disclosure Bulletin, Vol. 31, No. 12, May 1989, pages 49-50;
- “Cold Plate for Thermal conduction Module with Only Peripheral Mounting bolts, Large Surface Area Fin Inserts and Reduced Water Flow and Thermal Resistances”, IBM Technical Disclosure Bulletin, Vol. 31, No. 12, May 1989, page 59;
- “Thermal Control Hardware for Accelerated Run-In Testing of Multi-Chip Modules”, IBM Technical Disclosure Bulletin, Vol. 32, No. 5A, October 1989, page 129-130;
- “Means of Removing More Heat From a TCM (Or Other Liquid-Cooled Logic Package) By Reducing the Coolant Temperature”, IBM Technical Disclosure Bulletin, Vol. 32 No. 5A, Oct 1989, pages 153-154;
- E. G. Loeffel et al., “Liquid Cooled Module with Compliant Membrane”, IBM Technical Disclosure Bulletin, Vol. 20, No. 2, July 1977, pages 673-674;

- V. Y. Doo et al., “Method of Effective Cooling of a High Power Silicon Chip”, IBM Technical Disclosure Bulletin, Vol. 20, No. 4, September 1977, page 1436-1437;
- V. Y. Doo et al., “Semiconductor Chip Cooling Package, IBM Technical Disclosure Bulletin, Vol. 20, No. 4, September 1977, pages 1440-1441;
- “Heat Sink Fabrication Method”, IBM Technical Disclosure Bulletin, Vol. 27, No. 10A, March 1985, page 5656-5657;
- “Thermal Conduction Module with Liquid Dielectric and Pistons with Surface Treatment for Enhanced Nucleate Boiling”, IBM Technical Disclosure Bulletin, Vol. 27, No. 12, May 1985, page 6904;
- “Pin Fin Array Heat Pipe Apparatus”, IBM Technical Disclosure Bulletin, Vol. 37, No. 09, September 1994, page 171;
- Youngcheol Joo et al., “Fabrication of Monolithic Microchannels for IC Chip Cooling”, 1995, IEEE Micro Electro Mechanical Systems, pages 362-367;
- Jaisree Moorthy et al., Active control of electroosmotic flow in microchannels using light, January 26, 2001, Sensors and Actuators B 75, pages 223-229;
- Andreas Manz et al., Electroosmotic pumping and electrophoretic separations for miniaturized chemical analysis systems, September 16, 1994, J.Micromech. Microeng. 4 (1994), pages 257-265, printed in the U.K;
- E. B. Cummings et al., Irrotationality of uniform electroosmosis, September 1999, Part of the SPIE Conference on Microfluidic Devices and Systems II, SPIE Vol. 3877, pages 180-189;
- Stephen C. Jacobson et al., Fused Quartz Substrates for Microchip Electrophoresis, July 1, 1995, Analytical Chemistry, Vol. 67, No. 13, pages 2059-2063;
- Haim H. Bau, Optimization of conduits’ shape in micro heat exchangers, December 10, 1997, International Journal of Heat and Mass Transfer 41 (1998), pages 2717-2723;
- V. K. Dwivedi et al., Fabrication of very smooth walls and bottoms of silicon microchannels for heat dissipation of semiconductor devices, January 25, 2000, Microelectronics Journal 31 (2000), pages 405-410;

- M. B. Bowers et al., Two-Phase Electronic Cooling Using Mini-Channel and Micro-Channel Heat Sinks: Part 2-Flow Rate and Pressure Drop Constraints, December 1994, Journal of Electronic Packaging 116, pages 298-305;
- Meint J. de Boer et al., Micromachining of Buried Micro Channels in Silicon, March 2000, Journal of Microelectromechanical systems, Vol. 9, No. 1, pages 94-103;
- S.B. Choi et al., FLUID FLOW AND HEAT TRANSFER IN MICROTUBES, 1991, DSC-vol. 32, Micromechanical sensors, Actuators, and Systems, ASME 1991, pages 123-134;
- S. F. Choquette, M. Faghri et al., OPTIMUM DESIGN OF MICROCHANNEL HEAT SINKS, 1996, DSC-Vol. 59; Microelectromechanical Systems (MEMS), ASME 1996, pages 115-126;
- David Copeland et al., MANIFOLD MICROCHANNEL HEAT SINKS: THEORY AND EXPERIMENT, 1995, EEP-Vol. 10-2, Advances in Electronic Packaging ASME 1995, pages 829-835;
- J. M. Cuta et al., FORCED CONVECTION HEAT TRANSFER IN PARALLEL CHANNEL ARRAY MICROCHANNEL HEAT EXCHANGER, 1996, PID-Vol. 2 / HTD-Vol. 338, Advances in Energy efficiency, Heat/Mass Transfer Enhancement, ASME 1996, pages 17-23;
- K. Fushinobu et al., HEAT GENERATION AND TRANSPORT IN SUB-MICRON SEMICONDUCTOR DEVICES, 1993, HTD-Vol. 253, Heat Transfer on the Microscale, ASME 1993, pages 21-28;
- Charlotte Gillot et al., Integrated Micro Heat Sink for Power Multichip Module, September 3, 1999, IEEE Transactions on Industry Applications, Vol. 36. NO. 1. January/February 2000, pages 217-221;
- John Gooding, Microchannel heat exchangers - a review, SPIE Vol. 1997 High Heat Flux Engineering II (1993), pages 66-82;
- Koichiro Kawano et al., Micro Channel Heat Exchanger for Cooling Electrical Equipment, HTD-Vol. 361-3/PID-Vol. 3, Proceeding of the ASME Heat Transfer Division - Volume 3, ASME 1998, pages 173-188;
- Chad Harris et al., Design and Fabrication of a Cross Flow Micro Heat Exchanger, December 2000, Journal of Microelectromechanical Systems, Vol. 9, No. 4, pages 502-508;

- George M. Harpole et al., MICRO-CHANNEL HEAT EXCHANGER OPTIMIZATION, 1991, Seventh IEEE SEMI-THERM Symposium, pages 59-63;
- Pei-Xue Jiang et al., Thermal-hydraulic performance of small scale micro-channel and porous-media heat-exchangers, 2001, International Journal of Heat and Mass Transfer 44 (2001); pages 1039-1051;
- X.N. Jiang et al., Laminar Flow Through Microchannels Used for Microscale Cooling Systems, 1997, IEEE/CPMT Electronic Packaging Technology Conference, pages 119-122, Singapore;
- David Bazeley Tuckerman, Heat-Transfer Microstructures for Integrated Circuits, February 1984, pages ii-xix, pages 1-141;
- M Esashi, Silicon micromachining for integrated microsystems, 1996, Vacuum/volume 47/numbers 6-8/pages 469-474;
- T.S. Ravigururajan et al., Effects of Heat Flux on Two-Phase Flow characteristics of Refrigerant Flows in a Micro-Channel Heat Exchanger, HTD-Vol. 329, National Heat Transfer Conference, Volume 7, ASME 1996, pages 167-178;
- T.S. Ravigururajan et al., Single-Phase Flow Thermal Performance Characteristics of a Parallel Micro-Channel Heat Exchanger, 1996, HTD-Vol. 329, National Heat Transfer Conference, Volume 7, ASME 1996, pages 157-166;
- T.S. Ravigururajan et al., Liquid Flow Characteristics in a Diamond-Pattern Micro-Heat-Exchanger, DSC-Vol. 59 Microelectromechanical Systems (IMEMS), ASME 1996, pages 159-166;
- T.S. Ravigururajan, Impact of Channel Geometry on Two-Phase Flow Heat Transfer Characteristics of Refrigerants in Microchannel Heat Exchangers, May 1998, Journal of Heat Transfer, Vol. 120, pages 485-491;
- J. Pfahler et al., Liquid Transport in Micron and Submicron Channels, March 1990, Sensors and Actuators, A21-A23 (1990), pages 431-434;
- Kenneth Pettigrew et al., Performance of a MEMS based Micro Capillary Pumped Loop for Chip-Level Temperature Control, 2001, The 14th IEEE International Conference on Micro Electro Mechanical Systems, pages 427-430;

- C. Perret et al., Microchannel integrated heat sinks in silicon technology, October 12-15, 1998, The 1998 IEEE Industry Applications Conference, pages 1051-1055;
- X.F. Peng et al., Convective heat transfer and flow friction for water flow in microchannel structures, 1996, Int. J. Heat Mass Transfer, Vol. 39, No. 12, pages 2599-2608, printed in Great Britain;
- X.F. Peng et al., Experimental investigation of heat transfer in flat plates with rectangular microchannels, 1994, Int. J. Heat Mass Transfer, Vol. 38, No. 1, pages 127-137, printed in Great Britain;
- X.F. Peng et al., Cooling Characteristics with Microchanneled Structures, 1994, Enhanced Heat Transfer, Vol. 1, No. 4, pages 315-326, printed in the United States of America;
- Yoichi Murakami et al., Parametric Optimization of Multichanneled Heat Sinks for VLSI Chip Cooling, March 2002, IEEE Transaction on Components and Packaging Technologies, Vol. 24, No. 1, pages 2-9;
- D. Munding et al., High average power 2-D laser diode arrays on silicon microchannel coolers, CLEO '89/Friday Morning/404;
- L.J. Missaggia et al., Microchannel Heat Sinks for Two-Dimensional High-Power-Density Diode Laser Arrays, 1989, IEEE Journal of Quantum Electronics, Vol. 25, No. 9, September 1989, pages 1989-1992;
- M.J. Marongiu et al., Enhancement of Multichip Modules (MCMs) Cooling by Incorporating MicroHeatPipes and Other High Thermal Conductivity Materials into Microchannel Heat Sinks, 1998, Electronic Components and Technology Conference, pages 45-50;
- C.R. Friedrich et al., Micro heat exchangers fabricated by diamond machining, January 1994, Precision Engineering, Vol. 16, No. 1, pages 56-59;
- Mali Mahalingam, Thermal Management in Semiconductor Device Packaging, 1985, Proceedings of the IEEE, Vol. 73, No. 9, September 1985, pages 1396-1404;
- T.M. Adams et al., An experimental investigation of single-phase forced convection in microchannels, 1997, Int. J. Heat Mass Transfer, Vol. 41, Nos. 6-7, pages 851-857, Printed in Great Britain;

- T.M. Adams et al., Applicability of traditional turbulent single-phase forced convection correlations to non-circular microchannels, 1999, Int. J. Heat and Transfer 42 (1999) pages 4411-4415;
- Bassam Badran et al., Experimental Results for Low-Temperature Silicon Micromachined Micro Heat Pipe Arrays Using Water and Methanol as Working Fluids, May 31, 1997, Experimental Heat Transfer, 10: pages 253-272;
- D. Jed Harrison et al., Electroosmotic Pumping Within A Chemical Sensor System Integrated on Silicon, Session C9 Chemical Sensors and Systems for Liquids, June 26, 1991, pages 792-795;
- Kurt Seller et al., Electroosmotic Pumping and Valveless Control of Fluid Flow within a Manifold of Capillaries on a Glass Chip, 1994, Analytical Chemistry, Vol. 66, No. 20, October 15, 1994, pages 3485-3491;
- Philip H. Paul et al., Electrokinetic Generation of High Pressures Using Porous Microstructures, 1998, Micro-Total Analysis Systems, pages 49-52;
- Gh. Mohiuddin Mala et al., Flow characteristics of water through a microchannel between two parallel plates with electrokinetic effects, 1997, Int. J. Heat and Fluid Flow, Vol. 18, No. 5, pages 489-496;
- W.E. Morf et al., Partial electroosmotic pumping in complex capillary systems Part 1: Principles and general theoretical approach, October 16, 2000, Sensors and Actuators B 72 (2001), pages 266-272;
- M. Esashi, Silicon micromachining and micromachines, September 1, 1993, Wear, Vol. 168, No. 1-2, (1993), pages 181-187;
- Stephanus Buttgenbach et al., Microflow devices for miniaturized chemical analysis systems, November 4-5, 1998, SPIE-Chemical Microsensors and Applications, Vol. 3539, pages 51-61;
- Sarah Arunlanandam et al., Liquid transport in rectangular microchannels by electroosmotic pumping, 2000, Colloids and Surfaces A: Physicochemical and Engineering Aspects Vol. 161 (2000), pages 89-102;
- Linan Jiang et al., Closed-Loop Electroosmotic Microchannel Cooling System for VLSI Circuits, Mechanical Engineering Dept. Stanford University, pages 1-27;

- Susan L. R. Barker et al., Fabrication, Derivatization and Applications of Plastic Microfluidic Devices, Proceedings of SPIE, Vol. 4205. November 5-8, 2000, pages 112-118;
- Timothy E. McKnight et al., Electroosmotically Induced Hydraulic Pumping with Integrated Electrodes on Microfluidic Devices, 2001, Anal. Chem., Vol. 73, pages 4045-4049;
- Chris Bourne, Cool Chips plc RECEIVES NANOTECH MANUFACTURING PATENT, July 31, 2002, pages 1-2;
- Frank Wagner et al., Electroosmotic Flow Control in Micro Channels Produced by Scanning Excimer Laser Ablation, 2000, Proceedings of SPIE Vol. 4088, June 14-16, 2000, pages 337-340;
- H. A. Goodman, Data Processor Cooling With Connection To Maintain Flow Through Standby Pump, December 1983, IBM Technical Disclosure Bulletin, Vol. 26, No. 7A, page 3325;
- Electroerosion Micropump, May 1990, IBM Technical Disclosure Bulletin, Vol. 32, No. 12, pages 342-343;
- Shulin Zeng et al., Fabrication and Characterization of Electrokinetic Micro Pumps, 2000 Inter Society Conference on Thermal Phenomena, pages 31-35;
- A. Manz et al., Integrated Electroosmotic Pumps and Flow Manifolds for Total Chemical Analysis System, 1991, Inter. Conf. on Solid-State Sensors and Actuators, pages 939-941;
- O. T. Guenat et al., Partial electroosmotic pumping in complex capillary systems Part: 2 Fabrication and application of a micro total analysis system suited for continuous volumetric nanotitrations, October 16, 2000, Sensors and Actuators B 72 (2001) pages 273-282;
- J. G. Sunderland, Electrokinetic dewatering and thickening. I. Introduction and historical review of electrokinetic applications, September 1987, Journal of Applied Electrochemistry Vol. 17, No. 5, pages 889-898;
- J. C. Rife et al., Acousto- and electroosmotic microfluidic controllers, 1998, Microfluidic Devices and Systems, Vol. 3515, pages 125-135;
- Purnendu K Dasgupta et al., Electroosmosis: A Reliable Fluid Propulsion System for Flow Injection Analysis, 1994, Anal. Chem., Vol. 66, No. 11, pages 1792-1798;

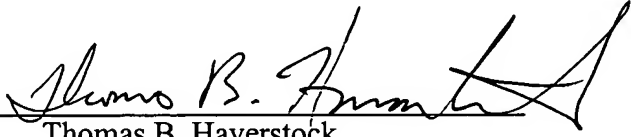
- Ray Beach et al., Modular Microchannel Cooled Heatsinks for High Average Power Laser Diode Arrays, April 1992, IEEE Journal of Quantum Electronics, Vol. 28, No. 4, pages 966-976;
- Roy W. Knight et al., Optimal Thermal Design of Air cooled Forced Convection finned Heat Sinks - Experimental Verification, October 1992, IEEE Transactions on Components, Hybrids, and Manufacturing Technology, Vol. 15, No. 5 pages 754-760;
- Y. Zhuang et al., Experimental study on local heat transfer with liquid impingement flow in two-dimensional micro-channels, 1997, Int. J. Heat Mass Transfer, Vol. 40, No. 17, pages 4055-4059;
- D. Yu et al., An Experimental and Theoretical Investigation of Fluid Flow and Heat Transfer in Microtube, 1995, ASME / JSME Thermal Engineering Conference, Vol. 1, pages 523-530;
- Xiaoqing Yin et al., Micro Heat Exchangers Consisting of Pin Arrays, 1997, Journal of Electronic Packaging March 1997, Vol. 119, pages 51-57;
- X. Yin et al., Uniform Channel Micro Heat Exchangers, 1997, Journal of Electronic Packaging June 1997, Vol. 119, No. 2, pages 89-94;
- Chun Yang et al., Modeling forced liquid convection in rectangular microchannels with electrokinetic effect, 1998, International Journal of Heat and Mass Transfer 41 (1998), pages 4229-4249;
- Arel Weisberg et al., Analysis of microchannels for integrated cooling, 1992, Int. J. Heat Mass Transfer, Vol. 35, No. 10, pages 2465-2473;
- Roger S. Stanley et al., Two-Phase Flow in Microchannels, 1997, DSE-Vol. 62/HTD-Vol. 354, MEMS, pages 143-152;
- B. X. Wang et al., Experimental investigation on liquid forced-convection heat transfer through microchannels, 1994, Int. J. Heat Mass Transfer, Vol. 37 Suppl. 1, pages 73-82;
- Kambiz Vafai et al., Analysis of two-layered micro-channel heat sink concept in electronic cooling, 1999, Int. J. Heat Mass Transfer, 42 (1999), pages 2287-2297;
- Gokturk Tunc et al., Heat transfer in rectangular microchannels, 2002, Int. J. Heat Mass Transfer, 45 (2002), pages 765-773;

- D. B. Tuckerman et al., High-Performance Heat Sinking for VLSI, 1981, IEEE Electron Device Letters, Vol. EDL-2, No. 5, pages 126-129;
- Bengt Sunden et al., An Overview of Fabrication Methods and Fluid Flow and Heat Transfer Characteristics of Micro Channels, pages 3-23;
- David S. Shen et al., Micro Heat Spreader Enhance Heat Transfer in MCMs, 1995, IEEE Multi-Chip Module Conference, pages 189-194;
- S. Sasaki et al., Optimal Structure for Microgrooved Cooling Fin for High-Power LSI Devices, Electronic Letters, December 4, 1986, Vol 22, No. 25;
- Vijay K. Samalam, Convective Heat Transfer in Microchannels, September 1989, Journal of Electronic Materials, Vol. 18, No. 5, pages 611-617;
- Sanjay K. Roy et al., A Very High Heat Flux Microchannel Heat Exchanger for Cooling of Semiconductor Laser Diode Arrays, 1996, IEEE Transactions on components, packaging, and manufacturing technology-part B, Vol. 19, No. 2, pages 444-451;
- Charlotte Gillot et al., Integrated Single and Two-Phase Micro Heat Sinks Under IGBT Chips, IEEE Transactions on Components and Packaging Technology, Vol. 22 No. 3, September 1999, pages 384-389;
- X.F. Peng et al., "Enhancing the Critical Heat Flux Using Microchanneled Surfaces", Enhanced Heat Transfer, 1998, Vol. 5 pp. 165-176;
- H. Krumm "Chip Cooling", IBM Technical Disclosure Bulletin, Vol. 20, No. 7, December 1977, pg. 2728;
- Jae-Mo Koo et al., "Modeling of Two-Phase Microchannel Heat Sinks for VLSI Chips", Mech. Eng. Depart. of Stanford University, pp. 422-426.

This Information Disclosure Statement under 37 C.F.R. §§ 1.56 and 1.97 is not to be construed as a representation that a search has been made, that additional information material to the examination of this application does not exist, or that anyone or more of these citations constitutes prior art.

Respectfully submitted,
HAVERSTOCK & OWENS LLP

Dated: 3-30-04

By: 
Thomas B. Haverstock
Reg. No.: 32,571

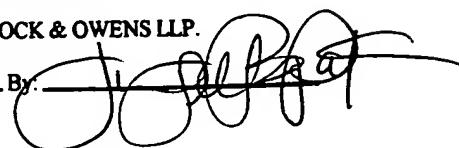
Attorneys for Applicants

CERTIFICATE OF MAILING (37 CFR § 1.8(a))

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited with the U.S. Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the: Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450

- 17 -

HAVERSTOCK & OWENS LLP.

Date: 3-30-04 By: 

FORM PTO-1449
(Modified)U.S. Department of Commerce
Patent and Trademark Office

Attorney Docket No.: COOL-01901

Serial No.: 10/731,674

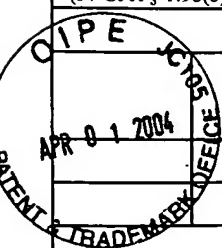
INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use Several Sheets If Necessary)

(37 CFR § 1.98(b))

Applicants: Daniel J. Lenehan et al.

Filing Date: December 8, 2003

Group Art Unit: 3753

FOREIGN PATENTS OR PUBLISHED FOREIGN PATENT APPLICATIONS

	Document Number	Publication Date	Country / Patent Office	Class	Subclass	Translation	
						Yes	No
AA	97212126.9	03/04/97	CN	BO1D	61/42		X
AB	2000-277540	10/06/00	JP	H01L	21/50		X

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)

AC	Stephen C. Jacobson et al., "Fused Quartz Substrates for Microchip Electrophoresis", Analytical Chemistry, Vo. 67, No. 13, July 1, 1995, pages 2059-2063.						
AD	Kendra V. Sharp et al., "Liquid Flows in Microchannels", 2002, Vol. 6, pages 6-1 to 6-38.						
AE	Shuchi Shoji et al., "Microflow devices and systems", J. Microcech. Microeng. 4 (1994), pages 157-171, printed in the U.K.						
AF	Angela Rasmussen et al., "Fabrication Techniques to Realize CMOS-Compatible Microfluidic Microchannels", Journal of Microelectromechanical, Vo. 10, No. 2, June 2001, pages 286-297.						
AG	J. H. Wang et al., "Thermal-Hydraulic Characteristic of Micro Heat Exchangers", 1991, DSC-Vol. 32, Micromechanical Sensors, Actuators, and Systems, pages 331-339.						
AH	Gad Hetsroni et al., "Nonuniform Temperature Distribution in Electronic Devices Cooled by Flow in Parallel Microchannels", IEEE Transactions on Components and Packaging Technologies, March 2001, Vol. 24, No. 1, pages 16-23.						
AI	X. F. Peng et al., "Heat Transfer Characteristics of Water Flowing through Microchannels", Experimental Heat Transfer An International Journal, Vol. 7, No. 4, October-December 1994, pages 265-283.						
AJ	Linan Jiang et al., "Forced Convection Boiling in a Microchannel Heat Sink", Journal of Microelectromechanical Systems, Vol. 10, No. 1, March 2001, pages 80-87.						
AK	Muhammad M. Rahman et al., "Experimental Measurements of Fluid Flow and Heat Transfer in Microchannel Cooling Passages in a Chip Substrate", 1993, EEP-Vol. 4-2, Advances in Electronic Packages, pages 685-692.						
AL	X. F. Peng et al., "Forced convection and flow boiling heat transfer for liquid flowing through Microchannels", 1993, Int. J. Heat Mass Transfer, Vol. 36, NO. 14, pages 3421-3427.						
AM	Lung-Jieh Yang et al., "A Micro Fluidic System of Micro Channels with On-Site Sensors by Silicon Bulk Micromaching", September 1999, Microfluidic Devices and Systems II, Vol. 3877, pages 267-272.						
AN	G. Mohiuddin Mala et al., "Heat transfer and fluid flow in microchannels", 1997, Int. J. Mass transfer, Vol. 40, No. 13, pages 3079-3088, printed in Great Britain.						
AO	J. M. Cuta et al., "Fabrication and Testing of Micro-Channel Heat Exchangers", SPIE Microlithography and Metrology in Micromaching, Vol. 2640, 1995, pages 152-160.						
AP	Linan Jiang et al., "A Micro-Channel Heat Sink with Integrated Temperature Sensors for Phase Transition Study", 1999, 12 th IEEE International Conference on Micro Electro Mechanical Systems, pages 159-164.						
AQ	Linan Jiang et al., "Fabrication and characterization of a microsystem for a micro-scale heat transfer study", J. Micromech. Microeng. 9 (1999) pages 422-428, printed in the U.K.						
AR	M. B. Bowers et al., "High flux boiling in low flow rate, low pressure drop mini-channel and micro-channel heat sinks", 1994, Int. J. Heat Mass Transfer, Vol. 37, No. 2, pages 321-332.						
AS	Yongendra Joshi, "Heat out of small packages", December 2001, Mechanical Engineer, pages 56-58.						
AT	A. Rostami et al., "Liquid Flow and Heat Transfer in Microchannels: a Review", 2000, Heat and Technology, Vol. 18, No. 2, pages 59-68.						
AU	Lian Zhang et al., "Measurements and Modeling of Two-Phase Flow in Microchannels with Nearly Constant Heat Flux Boundary Conditions", Journal of Microelectromechanical Systems, Vol. 11, No. 1, February 2002, pages 12-19.						
AV	Muhammad Mustafizur Rahman, "Measurements of Heat Transfer in Microchannel Heat Sinks", Int. Comm. Heat Mass Transfer, Vol. 27, No. 4, May 2000, pages 495-506.						
AW	Issam Mudawar et al., "Enhancement of Critical Heat Flux from High Power Microelectronic Heat Sources in a Flow Channel", Journal of Electronic Packaging, September 1990, Vol. 112, pages 241-248.						
AX	Nelson Kuan, "Experimental Evaluation of Micro Heat Exchangers Fabricated in Silicon", 1996, HTD-Vol. 331, National Heat Transfer Conference, Vol. 9, pages 131-136.						
AY	E. W. Kreutz et al., "Simulation of micro-channel heat sinks for optoelectronic microsystems", Microelectronics Journal 31(2000) pages 787-790.						
AZ	J. C. Y. Koh et al., "Heat Transfer of Microstructure for Integrated Circuits", 1986, Int. Comm. Heat Mass Transfer, Vol. 13, pages 89-98.						
BA	Snezana Konecni et al., "Convection Cooling of Microelectronic Chips", 1992, InterSociety Conference on Thermal Phenomena, pages 138-144.						

Examiner:

Date Considered:

EXAMINER:

Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

FORM PTO-1449
(Modified)U.S. Department of Commerce
Patent and Trademark Office

Attorney Docket No.: COOL-01901

Serial No.: 10/731,674

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use Several Sheets If Necessary)

Applicants: Daniel J. Lenehan et al.

(37 CFR § 1.98(b))

Filing Date: December 8, 2003

Group Art Unit: 3753

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)

BB

Michael B. Kleiner et al., "High Performance Forced Air Cooling Scheme Employing Microchannel Heat Exchangers", 1995, IEEE Transactions on Components, Packaging, and Manufacturing Technology-Part A, Vol. 18, No. 4, pages 795-804.

BC

Jerry K. Keska Ph. D. et al., "An Experimental Study on an Enhanced Microchannel Heat Sink for Microelectronics Applications", EEP-Vol. 26-2, Advances in Electronic Packaging, 1999, Vol. 2, pages 1235-1259.

BD

Shung-Wen Kang et al., "The Performance Test and Analysis of Silicon-Based Microchannel Heat Sink", July 1999, Terahertz and Gigahertz Photonics, Vol. 3795, pages 259-270.

BE

Joseph C. Tramontana, "Semiconductor Laser Body Heat Sink", Xerox Disclosure Journal, Vol. 10, No. 6, November/December 1985, pages 379-381.

BF

Sarah Arulanandam et al., "Liquid transport in rectangular microchannels by electroosmotic pumping", Colloid and Surfaces A: Physicochemical and Engineering Aspects 161 (2000), pages 89-102.

BG

Jeffery D. Barner et al., "Thermal Ink Jet Print Head Carriage with Integral Liquid Cooling Capabilities", Xerox Disclosure Journal-Vol. 21, No. 1, January/February 1996, pages 33-34.

BH

"Autonomous displacement of a solution in a microchannel by another solution", Research Disclosure, June 2001, pages 1046-1047.

BI

John M. Waldvogel, "Aluminum Silicon Carbide Phase Change Heat Spreader", Motorola, June 1999, Technical Developments, pages 226-230.

BJ

James P. Slupe et al., "An idea for maintaining a stable thermal environment for electronic devices", Research Disclosure, August 2001, page 1312.

BK

John M. Waldvogel, "A Heat Transfer Enhancement Method for Forced Convection Bonded-Fin Heatsinks", Motorola, December 1997, Technical Developments, pages 158-159.

BL

"Thin Heat Pipe for Cooling Components on Printed Circuit Boards", IBM Technical Disclosure Bulletin, Vol. 34, No. 7B, December 1991, pages 321-322.

BM

R. C. Chu et al., "Process for Nucleate Boiling Enhancement", IBM Technical Disclosure Bulletin, Vol. 18, No. 7, December 1975, page 2227.

BN

J. Riseman, "Structure for Cooling by Nucleate Boiling", IBM Technical Disclosure Bulletin, Vol. 18, No. 11, April 1976, page 3700.

BO

"Integrally Grooved Semiconductor Chip and Heat Sink", October 1971, IBM Technical Disclosure Bulletin, Vol. 14, No. 5, page 1425.

BP

"Enhanced Cooling of Thermal Conduction Module", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 426.

BQ

"Heat Exchanger Modules for Data Process with Valves Operated by Pressure form Cooling Water Pump", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 419.

BR

"Cold Plate for Thermal Conduction Module with Inlet for Cooling Water Near Highest Power Chips", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 413.

BS

"Circuit Module Cooling with Coaxial Bellow Providing Inlet, Outlet and Redundant Connections to Water-Cooled Element", IBM Technical Bulletin, Vol. 30, No. 5, October 1987, pages 345-347.

BT

"Piping System with Valves Controlled by Processor for Heating Circuit Modules in a Selected Temperature Profile for Sealing Integrity Test Under Temperature Stress", IBM Technical Disclosure Bulletin, Vol. 30, No. 5, October 1987, page 336.

BU

"Cooling System for Chip Carrier on Card", IBM Technical Disclosure Bulletin, Vol. 31, No. 4, September 1988, pages 39-40.

BV

"Chip Cooling Device", IBM Technical Disclosure Bulletin, Vol. 30, No. 9, February 1988, pages 435-436.

BW

W. E. Ahearn et al., "Silicon Heat Sink Method to Control Integrated Circuit Chip Operating Temperatures", IBM Technical Disclosure Bulletin, Vol. 21, No. 8, January 1979, pages 3378-3380.

BX

N. P. Bailey et al., "Cooling Device for Controlled Rectifier", IBM Technical Disclosure Bulletin, Vol. 21, No. 11, April 1979, pages 4609-4610.

BY

W. J. Kleinfelder et al., "Liquid-Filled Bellows Heat Sink", IBM Technical Disclosure Bulletin, Vol. 21, No. 10, March 1979, pages 4125-4126.

BZ

R. P. Chrisfield et al., "Distributed Power/Thermal Control", IBM Technical Disclosure Bulletin, Vol. 22, No. 3, August 1979, pages 1131-1132.

CA

A. J. Arnold et al., "Heat Sink Design for Cooling Modules in a Forced Air Environment", IBM Technical Disclosure Bulletin, Vol. 22, No. 6, November 1979, pages 2297-2298.

CB

A. J. Arnold, "Structure for the Removal of Heat from an Integrated Circuit Module", IBM Technical Disclosure Bulletin, Vol. 22, No. 6, November 1979, pages 2294-2296.

CC

U. P. Hwang et al., "Cold Plate for Thermal Conduction Module with Improved Flow Pattern and Flexible Base", IBM Technical Disclosure Bulletin, Vol. 25, No. 9, February 1983, page 4517.

CD

K. C. Gallagher et al., "Cooling System for Data Processor with Flow Restrictor in Secondary Loop to Limit Bypass-Cooling Water Flow", IBM Technical Disclosure Bulletin, Vol. 26, No. 5, October 1983, page 2658.

Examiner:

Date Considered:

EXAMINER:

Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

FORM PTO-1449
(Modified)U.S. Department of Commerce
Patent and Trademark Office

Attorney Docket No.: COOL-01901

Serial No.: 10/731,674

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use Several Sheets If Necessary)

Applicants: Daniel J. Lenehan et al.

(37 CFR § 1.98(b))

Filing Date: December 8, 2003

Group Art Unit: 3753

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)

CE	R. C. Chu et al., "Silicon Heat Sink for Semiconductor Chip", IBM Technical Disclosure Bulletin, Vol. 24, No. 11A, April 1982, page 5743.
CF	J. M. Eldridge et al., "Heat-Pipe Vapor Cooling Etched Silicon Structure", IBM Technical Disclosure Bulletin, Vol. 25, No. 8, January 1983, pages 4118-4119.
CG	J. R. Skobern, "Thermoelectrically Cooled Module", IBM Technical Disclosure Bulletin, Vol. 27, No. 1A, June 1984, page 30.
CH	M. J. Brady et al., "Etched Silicon Integrated Circuit Heat Sink", IBM Technical Disclosure Bulletin, Vol. 27, No. 1B, June 1984, page 627.
CI	H. D. Edmonds et al., "Heat Exchange Element for Semiconductor Device Cooling", IBM Technical Disclosure Bulletin, Vol. 23, No. 3, August 1980, page 1057.
CJ	R. W. Noth, "Heat Transfer from Silicon Chips and Wafers", IBM Technical Disclosure Bulletin, Vol. 17, No. 12, May 1975, page 3544.
CK	"Forced Boiling Cooling System with Jet Enhancement for Critical Heat Flux Extension", IBM Technical Disclosure Bulletin, Vol. 39, No. 10, October 1996, page 143.
CL	"Miniature Heat Exchanger for Corrosive Media", IBM Technical Disclosure Bulletin, Vol. 38, No. 01, January 1995, pages 55-56.
CM	"Self-Contained Active Heat Dissipation Device", IBM Technical Disclosure Bulletin Vol. 39, No. 04, April 1996, pages 115-116.
CN	C. J. Keller et al., "Jet Cooling Cup for Cooling Semiconductor Devices", IBM Technical Disclosure Bulletin, Vol. 20, No. 9, February 1978, pages 3575-3576.
CO	B. J. Ronkese, "Centerless Ceramic Package with Directly Connected Heat Sink", IBM Technical Disclosure Bulletin, Vol. 20, No. 9, February 1978, page 3577-3578.
CP	K. S. Sachar, "Liquid Jet Cooling of Integrated Circuit Chips", Vol. 20, No. 9, February 1978, pages 3727-3728.
CQ	A. H. Johnson, "Device Cooling", IBM Technical Disclosure Bulletin, Vol. 20, No. 10, March 1978, pages 3919-3920.
CR	A. L. Pacuzzo et al., "Integrated Circuit Module Package Cooling Structure", IBM Technical Disclosure Bulletin, Vol. 20, No. 10, March 1978, pages 3898-3899.
CS	R. D. Durand et al., "Flexible Thermal Conductor for Electronic Module", IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, page 4343.
CT	D. Balderes et al., "Liquid Cooling of a Multichip Module Package", IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, pages 4336-4337.
CU	J. A. Dorler et al., "Temperature Triggerable Fluid Coupling System for cooling Semiconductor Dies", IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, pages 4386-4388.
CV	V. W. Antonetti et al., "Integrated Module Heat Exchanger", IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, page 4498.
CW	P. Hwang et al., "Conduction Cooling Module", IBM Technical Disclosure Bulletin, Vol. 20, No. 11A, April 1978, pages 4334-4335.
CX	A. J. Arnold, "Electronic Packaging Structure", IBM Technical Disclosure Bulletin, Vol. 20, No. 11B, April 1978, pages 4820-4822.
CY	V. Y. Doo et al., "High Performance Package for Memory", IBM Technical Disclosure Bulletin, Vol. 21, No. 2, July 1978, pages 585-586.
CZ	"Multi-Chip Package with Cooling by a Spreader Plate in Contact with a Chip having Cylindrical Holes Mating with an Inverse Frame Providing Water Flow Within its Pins", IBM Technical Disclosure Bulletin, Vol. 31, No. 5, October 1988, pages 141-142.
DA	J. Landrock et al., "Cooling System for Semiconductor Chips", IBM Technical Disclosure Bulletin, Vol. 23, No. 4, September 1980, page 1483.
DB	E. P. Damm, Jr., "Convection Cooling Apparatus", IBM Technical Disclosure Bulletin, Vol. 20, No. 7, December 1977, pages 2755-2756.
DC	"Circuit Package with Circulating Boiling Liquid and Local Heat Exchanger to Limit Vapor in Coolant Outlet", IBM Technical Disclosure Bulletin, Vol. 31, No. 12 May 1989, page 34.
DD	"Circuit Module Cooling with Multiple Pistons Contacting a Heat Spreader/Electrical Buffer Plate in Contact with Chip", IBM Technical Disclosure Bulletin, Vol. 31, No. 12, May 1989, page 5-7.
DE	"TCM-LIKE Circuit Module with Local Heat Sink Resting on Chip and Chip Separated From Coolant by Bellows with Pins and Deflector Plate Attached to Local Heat Sink and Extending Above Bellows into Region of Coolant Flow", IBM Technical Disclosure Bulletin, Vol. 31, No. 11, pages 305-306.
DF	"Water-Cooled Circuit Module with Grooves Forming Water Passages Near Heat-Producing Devices", IBM Technical Disclosure Bulletin, Vol. 31, No. 12, May 1989, pages 49-50.
DG	"Cold Plate for Thermal conduction Module with Only Peripheral Mounting bolts, Large Surface Area Fin Inserts and Reduced Water Flow and Thermal Resistances", IBM Technical Disclosure Bulletin, Vol. 31, No. 12, May 1989, page 59.

Examiner:

Date Considered:

EXAMINER:

Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

FORM PTO-1449
(Modified)U.S. Department of Commerce
Patent and Trademark Office

Attorney Docket No.: COOL-01901

Serial No.: 10/731,674

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use Several Sheets If Necessary)

Applicants: Daniel J. Lenehan et al.

(37 CFR § 1.98(b))

Filing Date: December 8, 2003

Group Art Unit: 3753

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)

	DH	"Thermal Control Hardware for Accelerated Run-In Testing of Multi-Chip Modules", IBM Technical Disclosure Bulletin, Vol. 32, No. 5A, October 1989, page 129-130.
	DI	"Means of Removing More Heat From a TCM (Or Other Liquid-Cooled Logic Package) By Reducing the Coolant Temperature", IBM Technical Disclosure Bulletin, Vol. 32 No. 5A, Oct 1989, pages 153-154.
		E. G. Loeffel et al., "Liquid Cooled Module with Compliant Membrane", IBM Technical Disclosure Bulletin, Vol. 20, No. 2, July 1977, pages 673-674.
		V. Y. Doo et al., "Method of Effective Cooling of a High Power Silicon Chip", IBM Technical Disclosure Bulletin, Vol. 20, No. 4, September 1977, page 1436-1437.
	DL	V. Y. Doo et al., "Semiconductor Chip Cooling Package, IBM Technical Disclosure Bulletin, Vol. 20, No. 4, September 1977, pages 1440-1441.
	DM	"Heat Sink Fabrication Method", IBM Technical Disclosure Bulletin, Vol. 27, No. 10A, March 1985, page 5656-5657.
	DN	"Thermal Conduction Module with Liquid Dielectric and Pistons with Surface Treatment for Enhanced Nucleate Boiling", IBM Technical Disclosure Bulletin, Vol. 27, No. 12, May 1985, page 6904.
	DO	"Pin Fin Array Heat Pipe Apparatus", IBM Technical Disclosure Bulletin, Vol. 37, No. 09, September 1994, page 171.
	DP	Youngcheol Joo et al., "Fabrication of Monolithic Microchannels for IC Chip Cooling", 1995, IEEE Micro Electro Mechanical Systems, pages 362-367.
	DQ	Jaisree Moorthy et al., <u>Active control of electroosmotic flow in microchannels using light</u> , January 26, 2001, Sensors and Actuators B 75, pages 223-229.
	DR	Andreas Manz et al., <u>Electroosmotic pumping and electrophoretic separations for miniaturized chemical analysis systems</u> , September 16, 1994, J. Micromech. Microeng. 4 (1994), pages 257-265, printed in the U.K.
	DS	E. B. Cummings et al., <u>Irrotationality of uniform electroosmosis</u> , September 1999, Part of the SPIE Conference on Microfluidic Devices and Systems II, SPIE Vol. 3877, pages 180-189.
	DT	Stephen C. Jacobson et al., <u>Fused Quartz Substrates for Microchip Electrophoresis</u> , July 1, 1995, Analytical Chemistry, Vol. 67, No. 13, pages 2059-2063.
	DU	Haim H. Bau, <u>Optimization of conduits' shape in micro heat exchangers</u> , December 10, 1997, International Journal of Heat and Mass Transfer 41 (1998), pages 2717-2723.
	DV	V. K. Dwivedi et al., <u>Fabrication of very smooth walls and bottoms of silicon microchannels for heat dissipation of semiconductor devices</u> , January 25, 2000, Microelectronics Journal 31 (2000), pages 405-410.
	DW	M. B. Bowers et al., <u>Two-Phase Electronic Cooling Using Mini-Channel and Micro-Channel Heat Sinks: Part 2-Flow Rate and Pressure Drop Constraints</u> , December 1994, Journal of Electronic Packaging 116, pages 298-305.
	DX	Meint J. de Boer et al., <u>Micromachining of Buried Micro Channels in Silicon</u> , March 2000, Journal of Microelectromechanical systems, Vol. 9, No. 1, pages 94-103.
	DY	S.B. Choi et al., <u>FLUID FLOW AND HEAT TRANSFER IN MICROTUBES</u> , 1991, DSC-vol. 32, Micromechanical sensors, Actuators, and Systems, ASME 1991, pages 123-134.
	DZ	S. F. Choquette, M. Faghri et al., <u>OPTIMUM DESIGN OF MICROCHANNEL HEAT SINKS</u> , 1996, DSC-Vol. 59, Microelectromechanical Systems (MEMS), ASME 1996, pages 115-126.
	EA	David Copeland et al., <u>MANIFOLD MICROCHANNEL HEAT SINKS: THEORY AND EXPERIMENT</u> , 1995, EEP-Vol. 10-2, Advances in Electronic Packaging ASME 1995, pages 829-835.
	EB	J. M. Cuta et al., <u>FORCED CONVECTION HEAT TRANSFER IN PARALLEL CHANNEL ARRAY MICROCHANNEL HEAT EXCHANGER</u> , 1996, PID-Vol. 27 HTD-Vol. 338, Advances in Energy efficiency, Heat/Mass Transfer Enhancement, ASME 1996, pages 17-23.
	EC	K. Fushinobu et al., <u>HEAT GENERATION AND TRANSPORT IN SUB-MICRON SEMICONDUCTOR DEVICES</u> , 1993, HTD-Vol. 253, Heat Transfer on the Microscale, ASME 1993, pages 21-28.
	ED	Charlotte Gillot et al., <u>Integrated Micro Heat Sink for Power Multichip Module</u> , September 3, 1999, IEEE Transactions on Industry Applications, Vol. 36, NO. 1, January/February 2000, pages 217-221.
	EE	John Gooding, <u>Microchannel heat exchangers - a review</u> , SPIE Vol. 1997 High Heat Flux Engineering II (1993), pages 66-82.
	EF	Koichiro Kawano et al., <u>Micro Channel Heat Exchanger for Cooling Electrical Equipment</u> , HTD-Vol. 361-3/PID-Vol. 3, Proceeding of the ASME Heat Transfer Division - Volume 3, ASME 1998, pages 173-188.
	EG	Chad Harris et al., <u>Design and Fabrication of a Cross Flow Micro Heat Exchanger</u> , December 2000, Journal of Microelectromechanical Systems, Vol. 9, No. 4, pages 502-508.

Examiner:

Date Considered:

EXAMINER: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

FORM PTO-1449
(Modified)U.S. Department of Commerce
Patent and Trademark Office

Attorney Docket No.: COOL-01901

Serial No.: 10/731,674

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use Several Sheets If Necessary)

Applicants: Daniel J. Lenehan et al.

(37 CFR § 1.98(b))

Filing Date: December 8, 2003

Group Art Unit: 3753

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)

EH	George M. Harpole et al., <u>MICRO-CHANNEL HEAT EXCHANGER OPTIMIZATION</u> , 1991, Seventh IEEE SEMI-THERM Symposium, pages 59-63.
EI	Pei-Xue Jiang et al., <u>Thermal-hydraulic performance of small scale micro-channel and prous-media heat-exchangers</u> , 2001, International Journal of Heat and Mass Transfer 44 (2001), pages 1039-1051.
EJ	X.N. Jiang et al., <u>Laminar Flow Through Microchannels Used for Microscale Cooling Systems</u> , 1997, IEEE/CPMT Electronic Packaging Technology Conference, pages 119-122, Singapore.
EK	David Bazeley Tuckerman, <u>Heat-Transfer Microstructures for Integrated Circuits</u> , February 1984, pages ii-xix, pages 1-141.
EL	M Esashi, <u>Silicon micromachining for integrated microsystems</u> , 1996, Vacuum/volume 47/numbers 6-8/pages 469-474.
EM	T.S. Ravigurujan et al., <u>Effects of Heat Flux on Two-Phase Flow characteristics of Refrigerant Flows in a Micro-Channel Heat Exchanger</u> , HTD-Vol. 329, National Heat Transfer Conference, Volume 7, ASME 1996, pages 167-178.
EN	T.S. Ravigurujan et al., <u>Single-Phase Flow Thermal Performance Characteristics of a Parallel Micro-Channel Heat Exchanger</u> , 1996, HTD-Vol. 329, National Heat Transfer Conference, Volume 7, ASME 1996, pages 157-166.
EO	T.S. Ravigurujan et al., <u>Liquid Flow Characteristics in a Diamond-Pattern Micro-Heat-Exchanger</u> , DSC-Vol. 59 Microelectromechanical Systems (IMEMS), ASME 1996, pages 159-166.
EP	T.S. Ravigurujan, <u>Impact of Channel Geometry on Two-Phase Flow Heat Transfer Characteristics of Refrigerants in Microchannel Heat Exchangers</u> , May 1998, Journal of Heat Transfer, Vol. 120, pages 485-491.
EQ	J. Pfahler et al., <u>Liquid Transport in Micron and Submicron Channels</u> , March 1990, Sensors and Actuators, A21-A23 (1990), pages 431-434.
ER	Kenneth Pettigrew et al., <u>Performance of a MEMS based Micro Capillary Pumped Loop for Chip-Level Temperature Control</u> , 2001, The 14 th IEEE International Conference on Micro Electro Mechanical Systems, pages 427-430.
ES	C. Perret et al., <u>Microchannel integrated heat sinks in silicon technology</u> , October 12-15, 1998, The 1998 IEEE Industry Applications Conference, pages 1051-1055.
ET	X.F. Peng et al., <u>Convective heat transfer and flow friction for water flow in microchannel structures</u> , 1996, Int. J. Heat Mass Transfer, Vol. 39, No. 12, pages 2599-2608, printed in Great Britain.
EU	X.F. Peng et al., <u>Experimental investigation of heat transfer in flat plates with rectangular microchannels</u> , 1994, Int. J. Heat Mass Transfer, Vol. 38, No. 1, pages 127-137, printed in Great Britain.
EV	X.F. Peng et al., <u>Cooling Characteristics with Microchanneled Structures</u> , 1994, Enhanced Heat Transfer, Vol. 1, No. 4, pages 315-326, printed in the United States of America.
EW	Yoichi Murakami et al., <u>Parametric Optimization of Multichanneled Heat Sinks for VLSI Chip Cooling</u> , March 2002, IEEE Transaction on Components and Packaging Technologies, Vol. 24, No. 1, pages 2-9.
EX	D. Mundinger et al., <u>High average power 2-D laser diode arrays or silicon microchannel coolers</u> , CLEO '89/Friday Morning/404.
EY	L.J. Missaggia et al., <u>Microchannel Heat Sinks for Two-Dimensional High-Power-Density Diode Laser Arrays</u> , 1989, IEEE Journal of Quantum Electronics, Vol. 25, No. 9, September 1989, pages 1989-1992.
EZ	M.J. Marongiu et al., <u>Enhancement of Multichip Modules (MCMs) Cooling by Incorporating MicroHeatPipes and Other High Thermal Conductivity Materials into Microchannel Heat Sinks</u> , 1998, Electronic Components and Technology Conference, pages 45-50.
FA	C.R. Friedrich et al., <u>Micro heat exchangers fabricated by diamond machining</u> , January 1994, Precision Engineering, Vol. 16, No. 1, pages 56-59.
FB	Mali Mahalingam, <u>Thermal Management in Semiconductor Device Packaging</u> , 1985, Proceedings of the IEEE, Vol. 73, No. 9, September 1985, pages 1396-1404.
FC	T.M. Adams et al., <u>An experimental investigation of single-phase forced convection in microchannels</u> , 1997, Int. J. Heat Mass Transfer, Vol. 41, Nos. 6-7, pages 851-857, Printed in Great Britain.
FD	T.M. Adams et al., <u>Applicability of traditional turbulent single-phase forced convection correlations to non-circular microchannels</u> , 1999, Int. J. Heat and Mass Transfer 42 (1999) pages 4411-4415.
FE	Bassam Badran et al., <u>Experimental Results for Low-Temperature Silicon Micromachined Micro Heat Pipe Arrays Using Water and Methanol as Working Fluids</u> , May 31, 1997, Experimental Heat Transfer, 10: pages 253-272.
FF	D. Jed Harrison et al., <u>Electroosmotic Pumping Within A Chemical Sensor System Integrated on Silicon</u> , Session C9 Chemical Sensors and Systems for Liquids, June 26, 1991, pages 792-795.
FG	Kurt Seller et al., <u>Electroosmotic Pumping and Valveless Control of Fluid Flow within a Manifold of Capillaries on a Glass Chip</u> , 1994, Analytical Chemistry, Vol. 66, No. 20, October 15, 1994, pages 3485-3491.
FH	Philip H. Paul et al., <u>Electrokinetic Generation of High Pressures Using Porous Microstructures</u> , 1998, Micro-Total Analysis Systems, pages 49-52.
FI	Gh. Mohiuddin Mala et al., <u>Flow characteristics of water through a microchannel between two parallel plates with electrokinetic effects</u> , 1997, Int. J. Heat and Fluid Flow, Vol. 18, No. 5, pages 489-496.

Examiner:

Date Considered:

EXAMINER:

Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

FORM PTO-1449
(Modified)U.S. Department of Commerce
Patent and Trademark Office

Attorney Docket No.: COOL-01901

Serial No.: 10/731,674

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use Several Sheets If Necessary)

Applicants: Daniel J. Lenehan et al.

(37 CFR § 1.98(b))

Filing Date: December 8, 2003

Group Art Unit: 3753

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)

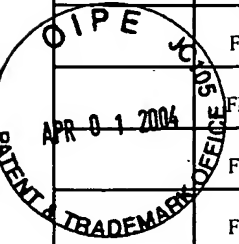
FJ	W.E. Morf et al., <u>Partial electroosmotic pumping in complex capillary systems Part 1: Principles and general theoretical approach</u> , October 16, 2000, <u>Sensors and Actuators B 72 (2001)</u> , pages 266-272.
FK	M. Esashi, <u>Silicon micromachining and micromachines</u> , September 1, 1993, <u>Wear</u> , Vol. 168, No. 1-2, (1993), pages 181-187.
FL	Stephanus Buttgenbach et al., <u>Microflow devices for miniaturized chemical analysis systems</u> , November 4-5, 1998, <u>SPIE-Chemical Microsensors and Applications</u> , Vol. 3539, pages 51-61.
FM	Sarah Arunlanandam et al., <u>Liquid transport in rectangular microchannels by electroosmotic pumping</u> , 2000, <u>Colloids and Surfaces A: Physicochemical and Engineering Aspects</u> Vol. 161 (2000), pages 89-102.
FN	Linan Jiang et al., <u>Closed-Loop Electroosmotic Microchannel Cooling System for VLSI Circuits</u> , Mechanical Engineering Dept. Stanford University, pages 1-27.
FO	Susan L. R. Barker et al., <u>Fabrication, Derivatization and Applications of Plastic Microfluidic Devices</u> , <u>Proceedings of SPIE</u> , Vol. 4205, November 5-8, 2000, pages 112-118.
FP	Timothy E. McKnight et al., <u>Electroosmotically Induced Hydraulic Pumping with Integrated Electrodes on Microfluidic Devices</u> , 2001, <u>Anal. Chem.</u> , Vol. 73, pages 4045-4049.
FQ	Chris Bourne, <u>Cool Chips plc RECEIVES NANOTECH MANUFACTURING PATENT</u> , July 31, 2002, pages 1-2.
FR	Frank Wagner et al., <u>Electroosmotic Flow Control in Micro Channels Produced by Scanning Excimer Laser Ablation</u> , 2000, <u>Proceedings of SPIE</u> Vol. 4088, June 14-16, 2000, pages 337-340.
FS	H. A. Goodman, <u>Data Processor Cooling With Connection To Maintain Flow Through Standby Pump</u> , December 1983, <u>IBM Technical Disclosure Bulletin</u> , Vol. 26, No. 7A, page 3325.
FT	<u>Electroerosion Micropump</u> , May 1990, <u>IBM Technical Disclosure Bulletin</u> , Vol. 32, No. 12, pages 342-343.
FU	Shulin Zeng et al., <u>Fabrication and Characterization of Electrokinetic Micro Pumps</u> , 2000 <u>Inter Society Conference on Thermal Phenomena</u> , pages 31-35.
FV	A. Manz et al., <u>Integrated Electroosmotic Pumps and Flow Manifolds for Total Chemical Analysis System</u> , 1991, <u>Inter. Conf. on Solid-State Sensors and Actuators</u> , pages 939-941.
FW	O. T. Guenat et al., <u>Partial electroosmotic pumping in complex capillary systems Part: 2 Fabrication and application of a micro total analysis system suited for continuous volumetric nanotitrations</u> , October 16, 2000, <u>Sensors and Actuators B 72 (2001)</u> pages 273-282.
FX	J. G. Sunderland, <u>Electrokinetic dewatering and thickening. I. Introduction and historical review of electrokinetic applications</u> , September 1987, <u>Journal of Applied Electrochemistry</u> Vol. 17, No. 5, pages 889-898.
FY	J. C. Rife et al., <u>Acousto- and electroosmotic microfluidic controllers</u> , 1998, <u>Microfluidic Devices and Systems</u> , Vol. 3515, pages 125-135.
FZ	Purnendu K Dasgupta et al., <u>Electroosmosis: A Reliable Fluid Propulsion System for Flow Injection Analysis</u> , 1994, <u>Anal. Chem.</u> , Vol. 66, No. 11, pages 1792-1798.
GA	Ray Beach et al., <u>Modular Microchannel Cooled Heatsinks for High Average Power Laser Diode Arrays</u> , April 1992, <u>IEEE Journal of Quantum Electronics</u> , Vol. 28, No. 4, pages 966-976.
GB	Roy W. Knight et al., <u>Optimal Thermal Design of Air cooled Forced Convection finned Heat Sinks - Experimental Verification</u> , October 1992, <u>IEEE Transactions on Components, Hybrids, and Manufacturing Technology</u> , Vol. 15, No. 5 pages 754-760.
GC	Y. Zhuang et al., <u>Experimental study on local heat transfer with liquid impingement flow in two-dimensional micro-channels</u> , 1997, <u>Int. J. Heat Mass Transfer</u> , Vol. 40, No. 17, pages 4055-4059.
GD	D. Yu et al., <u>An Experimental and Theoretical Investigation of Fluid Flow and Heat Transfer in Microtube</u> , 1995, <u>ASME / JSME Thermal Engineering Conference</u> , Vol. 1, pages 523-530.
GE	Xiaoqing Yin et al., <u>Micro Heat Exchangers Consisting of Pin Arrays</u> , 1997, <u>Journal of Electronic Packaging</u> March 1997, Vol. 119, pages 51-57.
GF	X. Yin et al., <u>Uniform Channel Micro Heat Exchangers</u> , 1997, <u>Journal of Electronic Packaging</u> June 1997, Vol. 119, No. 2, pages 89-94.
GG	Chun Yang et al., <u>Modeling forced liquid convection in rectangular microchannels with electrokinetic effect</u> , 1998, <u>International Journal of Heat and Mass Transfer</u> 41 (1998), pages 4229-4249.
GH	Arel Weisberg et al., <u>Analysis of microchannels for integrated cooling</u> , 1992, <u>Int. J. Heat Mass Transfer</u> , Vol. 35, No. 10, pages 2465-2473.
GI	Roger S. Stanley et al., <u>Two-Phase Flow in Microchannels</u> , 1997, <u>DSE-Vol. 62/HTD-Vol. 354, MEMS</u> , pages 143-152.
GJ	B. X. Wang et al., <u>Experimental investigation on liquid forced-convection heat transfer through microchannels</u> , 1994, <u>Int. J. Heat Mass Transfer</u> , Vol. 37 Suppl. 1, pages 73-82.
GK	Kambiz Vafai et al., <u>Analysis of two-layered micro-channel heat sink concept in electronic cooling</u> , 1999, <u>Int. J. Heat Mass Transfer</u> , 42 (1999), pages 2287-2297.

Examiner:

Date Considered:

EXAMINER:

Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.



FORM PTO-1449
(Modified)U.S. Department of Commerce
Patent and Trademark Office

Attorney Docket No.: COOL-01901

Serial No.: 10/731,674

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use Several Sheets If Necessary)

Applicants: Daniel J. Lenehan et al.

(37 CFR § 1.98(b))

Filing Date: December 8, 2003

Group Art Unit: 3753

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)

GL	Gokturk Tune et al., <u>Heat transfer in rectangular microchannels</u> , 2002, Int. J. Heat Mass Transfer, 45 (2002), pages 765-773.
GM	D. B. Tuckerman et al., <u>High-Performance Heat Sinking for VLSI</u> , 1981, IEEE Electron Device Letters, Vol. EDL-2, No. 5, pages 126-129.
GN	Bengt Sundén et al., <u>An Overview of Fabrication Methods and Fluid Flow and Heat Transfer Characteristics of Micro Channels</u> , pages 3-23.
GO	David S. Shen et al., <u>Micro Heat Spreader Enhance Heat Transfer in MCMs</u> , 1995, IEEE Multi-Chip Module Conference, pages 189-194.
GP	S. Sasaki et al., <u>Optimal Structure for Microgrooved Cooling Fin for High-Power LSI Devices</u> , Electronic Letters, December 4, 1986, Vol 22, No. 25.
GQ	Vijay K. Samalam, <u>Convective Heat Transfer in Microchannels</u> , September 1989, Journal of Electronic Materials, Vol. 18, No. 5, pages 611-617.
GR	Sanjay K. Roy et al., <u>A Very High Heat Flux Microchannel Heat Exchanger for Cooling of Semiconductor Laser Diode Arrays</u> , 1996, IEEE Transactions on components, packaging, and manufacturing technology-part B, Vol. 19, No. 2, pages 444-451.
GS	Charlotte Gillot et al., <u>Integrated Single and Two-Phase Micro Heat Sinks Under IGBT Chips</u> , IEEE Transactions on Components and Packaging Technology, Vol. 22 No. 3, September 1999, pages 384-389.
GT	X.F. Peng et al., "Enhancing the Critical Heat Flux Using Microchanneled Surfaces", Enhanced Heat Transfer, 1998, Vol. 5 pp. 165-176.
GU	H. Krumm "Chip Cooling", IBM Technical Disclosure Bulletin, Vol. 20, No. 7, December 1977, pg. 2728.
GV	Jae-Mo Koo et al., "Modeling of Two-Phase Microchannel Heat Sinks for VLSI Chips", Mech. Eng. Depart. of Stanford University, pp. 422-426.
GW	
GX	
GY	
GZ	
HA	
HB	
HC	
HD	
HE	
HF	
HG	
HH	
HI	
HJ	
HK	
HL	
HM	
HN	
HO	
HP	
HQ	
HR	
HS	
HT	

Examiner:

Date Considered:

EXAMINER:

Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

